

WORKING DRAFT MASSACHUSETTS DROUGHT MANAGEMENT PLAN



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*This draft is considered a working draft as it is intended to be used by the Drought Management Task Force and other agencies. However, revisions to this draft will be considered as additional comments are received and experience is gained with the procedures and methods contained in the document.

Working Draft Final Massachusetts Drought Management Plan

1. Introduction

The Executive Office of Environmental Affairs (EOEA) and the Massachusetts Emergency Management Agency (MEMA) have developed this plan to guide state activities in response to droughts and extended periods of dry weather. The operating procedure outlines the responsibilities of various state and federal agencies, the lines of communications to be used, the general sequence of actions to be followed based on the severity of the situation, and the emergency powers available to local and state government agencies. This plan was developed in consultation with the Drought Management Task Force (DMTF), which is described in more detail below.

1.1 Background and History

The Commonwealth of Massachusetts is often considered a “water-rich” state. Under normal conditions, regions across the state annually receive between 40 and 50 inches of precipitation. However, Massachusetts can experience extended periods of dry weather, from single season events to multi-year events such as experienced in the mid 1960s. Historically, most droughts in Massachusetts have started with dry winters, rather than a dry summer.

This Plan is being developed as part of the response to the period of precipitation deficiency beginning in the spring and summer of 1999. In some areas of the state, cumulative deficits in precipitation reached 8-12 inches below normal over a 12-month period. Streamflows across much of the state routinely fell below the 25th percentile of their historical flows for the month (within the lowest 25 percent on record for the month) and many with long periods on record, set record low streamflow levels. Ground water levels were also below normal throughout the summer over almost the entire state. While the Metropolitan District Commission’s (MDC) Quabbin and Wachusett Reservoirs were at near normal capacity during the summer, Worcester’s reservoir dropped to only 60-70 percent of capacity. Worcester is a member of the MWRA so the City was not in trouble. But it was necessary for Worcester to supplement its supply with MDC water for the first time in almost 20 years.

Precipitation remained below normal for the period from April, 1999 to March, 2000. While the summer of 2000 provided relief from these dry conditions, it is worth noting that the conditions in the first few months of the year were slightly worse than the early years of the drought of record experienced during the 1960’s.

State and federal agencies met on August 31, 1999 at the Massachusetts Emergency Management Agency Operations Center in Framingham as an ad-hoc drought management task force. At the meeting, each agency presented information from their respective office on the water supply status or impacts related to water deficiency. This allowed all members to obtain a clear understanding of the current situation, come to a conclusion on the status, and develop recommendations in preparation for future dry conditions. The group agreed to meet again to reassess the situation and develop further

plans should the dry weather continue. The group agreed that developing some standard procedures would help to facilitate response to the current and future situations.

1.2 Purpose

The purpose of this standard operating procedure is to help federal and state agencies:

1. Coordinate their activities in response to drought situations;
2. Identify responsibilities for information collection needed to assess the impacts from dry conditions;
3. Establish a consistent basis for evaluating the severity of drought situations;
4. Identify the lines of communications to allow the smooth flow of information to decision-makers;
5. Summarize the emergency powers available to government agencies to respond to drought situations.

2. Drought Management Task Force

The primary vehicle through which drought response is managed is the Drought Management Task Force (DMTF). The purpose of the Drought Management Task Force is to monitor, coordinate, and manage response to drought situations and to make recommendations to the appropriate entities to ensure impacts to public health, safety, the environment and agriculture are minimized.

2.1 Coordination of the Task Force

Coordinating the DMTF is the joint responsibility of the Executive Office of Environmental Affairs (EOEA) and the Massachusetts Emergency Management Agency (MEMA). They are jointly responsible for:

- Calling the task force together as necessary;
- Collecting and disseminating data on the status of the drought;
- Establishing agendas for DMTF meetings;
- Facilitating the DMTF meetings;
- Preparing DMTF meeting summaries;
- Coordinating communications between government agencies and the general public;
- Forwarding recommendations to the appropriate entities.

The DMTF and the role of the coordinating agencies are not intended to infringe upon the statutory or other obligations of the various agencies who are members of the task force or who are responsible for responding to any particular situation. Both the Task Force and the coordinating agencies serve to facilitate the activities of the task force members and ensure there is a coordinated response by state and federal agencies to drought situations.

2.2 Task Force Membership

The task force consists of officials from state and federal agencies as well as certain professional organizations that have responsibility for areas likely to be affected by drought conditions. In addition, the task force includes representatives of agencies that provide data related to assessing the severity of drought conditions, such as representatives from the United States Geologic Survey (USGS), National Weather

Service (NWS), and other public health and safety professionals. Finally, the task force includes representatives of agencies that have the ability to participate in responding to drought conditions, such as public health officials, public safety officials and the Army Corps of Engineers.

The contact list for the task force is contained in Appendix A. It is the responsibility of the coordinating agencies to maintain an up-to-date list of task force members.

2.3 Task Force Responsibilities

The role of the Task Force is to facilitate communication, provide the ability to comprehensively assess the situation, and to jointly develop recommendations to respond to drought situations. Therefore, the two primary responsibilities of the task force are to gather the information necessary to assess the impact of dry conditions and to make recommendations to agencies responsible for responding to drought or drought-related impacts. In the event of a severe drought, the task force makes recommendations for declaring regional or statewide emergencies and for developing and coordinating implementation of emergency responses. Each of these responsibilities is discussed below.

2.4 Task Force Recommendations

Implementation of the DMTF recommendations is the responsibility of the appropriate agency based on its jurisdiction or expertise. MEMA and EOEA staff will follow-up with the responsible agencies to help ensure the successful implementation of task force recommendations. For recommendations to either the Secretary of Public Safety, the Secretary of Environmental Affairs, the Commissioner of Public Health, or to the Governor, the EOEA and MEMA coordinators will cooperate in developing and forwarding recommendations through the appropriate chain(s) of command.

3. Data Collection

Monitoring trends and collecting pertinent information is vital to making timely and accurate decisions. Therefore, this plan spells out the responsibilities of various agencies to provide information that can be used to assess the severity of drought conditions and to assess impacts to the public health, economic viability and natural environment of the Commonwealth.

3.1 Data Collection by Task Force Members

When persistent dry conditions occur, agencies will be asked by the DMTF coordinators to begin collecting specific pieces of information and providing summaries of this information to the DMTF coordinators.

3.2 Data Reporting

Data provided by the respective agencies will be compiled into the “Current Conditions Report”, a report summarizing current water resource conditions that is prepared on a monthly basis by the Department of Environmental Management for the Water Resources Commission (WRC). This report, which has been produced since June, 1999 will include ground water data, surface water data, reservoir data, precipitation data, and streamflow conditions as well as reports on fire danger and agricultural conditions.

A description of the data collection responsibilities for each agency is provided in Table 1.

Table 1 - Information collection responsibilities

Information	Agency
Summary of state ground water levels, surface water levels, streamflow conditions.	Department of Environmental Management (DEM) United States Geological Survey (USGS)
Summary of extended forecast (3-month intervals). Summary of historical comparisons.	National Weather Service (NWS)
Summary of precipitation data	DEM Office of Water Resources National Weather Service
List of communities with mandatory water bans and declared water emergencies.	Department of Environmental Protection (DEP)
Other drinking water quality, water pressure or public health concerns associated with drinking water supplies.	Department of Environmental Protection Department of Public Health Massachusetts Water Works Association (MWWA)
Quabbin and Wachusett reservoir levels.	Metropolitan District Commission (MDC) and Massachusetts Water Resources Authority (MWRA)
Status of other major reservoirs throughout state	Department of Environmental Management
Status of MWRA Communities' water supplies	Massachusetts Water Resources Authority
Update of forest fire conditions.	DEM Bureau of Forest Fire Control
Update of crop, soil, and agriculture conditions and impacts.	Department of Food and Agriculture (DFA) USDA Farm Services
Summary of public utility issues.	Department of Telecommunications and Energy (DTE)
Summary of public health issues.	Department of Public Health (DPH) Massachusetts Association of Health Boards (MAHB)
Status of US Army Corps of Engineers water resources.	United States Army Corps of Engineers (USACE)
Drought Indices	Department of Environmental Management
Impacts to ecosystems, flora, and fauna	Department of Fish, Wildlife and Environmental Law Enforcement (DFWELE)
Other	As Reported

4. Communications

Ensuring that clear lines of communication are in place for communicating with the public and decision-makers to ensure they have accurate information on which to base decisions is a key component to managing drought situations. Therefore, this plan outlines a general communications framework for agencies to follow. These are discussed based on the target audience needing to receive information.

4.1 Communicating to the General Public

It is extremely important that accurate and timely information about the current status of dry conditions and the resultant impacts are communicated to the public. It will be the responsibility of the DMTF coordinating agencies to coordinate the activities of state agencies in their communications with the general public. Their respective press offices will be the primary vehicles through which information will be made available to the media and to the general public. MEMA, EOEA and DPH will jointly form recommendations about when announcements from one or both of the Secretaries, the Commissioner of Public Health or from the Governor are warranted to bring attention to the situation or to communicate about specific response actions.

If other agencies or groups determine that communication to the general public about dry conditions or drought response is necessary, they will coordinate with EOEA, MEMA and DPH on how best to accomplish this, whether the agency will communicate directly with the media or public or whether EOEA or MEMA will make the required announcements. Drafts of press releases and other communications to the general public should be shared with MEMA, EOEA and DPH before they are released to ensure a consistent message is being communicated.

4.2 Communicating to Target Audiences

In general state agencies will be responsible for communicating with their constituents. A summary of contacts is provided in Table 2:

Table 2: State Agency Communications*

General Public	EOEA and MEMA MWRA for MWRA service area
Public Water Suppliers	Department of Environmental Protection
MWRA Community Water Suppliers	Massachusetts Water Resources Authority
Local Boards of Health	Department of Public Health Department of Environmental Protection
Foresters	Department of Environmental Management
Farmers	Department of Food and Agriculture
Other Large Water Users-i.e. Industrial, golf courses, etc.	DEP
Local Fire Departments	DEM

* As this drought management plan is to facilitate coordination between state agencies, Table 2 identifies the communications responsibilities for state agencies. It is understood

that local governments and water suppliers play a key role in communications with the public.

5. Drought Action Levels

Unlike many other emergency situations, the severity of droughts develops over time and therefore present the opportunity to develop and implement appropriate measures as the situation worsens. Therefore, the Drought Management Plan defines action levels that define general levels of response given the severity of the situation.

5.1 Regionally-based Action Levels

Though Massachusetts encompasses a relatively small geographic area, the state has a number of distinct regions that can experience significantly different weather patterns and react differently to the amount of precipitation they receive. Therefore, assessments of drought conditions by the DMTF will be undertaken on a regional basis, rather than using a single statewide assessment.

The DEM precipitation index divides the state into six regions: Western, Central, Connecticut River Valley, Northeast, Southeast, and Cape and Islands. The MWRA service area will also be considered a separate region (MWRA has a drought management plan that identifies drought stages and responses). Because drought conditions may vary due to precipitation patterns, these regions may be adjusted based on the conditions in any particular drought situation. In addition, areas served by water supplies outside their region (most notably the MWRA water communities) will have their drought conditions assessed by the capacity of their system, rather than by the regional indices. The purpose for a regional approach is to allow regions to customize drought actions and conservation measures as needed to address the particular situation in each region. These regions also vary in population, density, water demand, topography, and runoff characteristics. Because of these different characteristics, different responses may be needed.

5.2 Action Levels

This Plan outlines five general action levels related to drought conditions:

- Normal
- Advisory
- Watch
- Warning
- Emergency

The levels provide a basic framework from which to take actions to assess, communicate, and respond to drought conditions. They begin with normal situation where data is routinely collected and distributed, move to heightened vigilance with increased data collection during an advisory, to increased assessment and proactive education during a watch. Water restrictions might be appropriate at the watch or warning stage, depending on the capacity of each individual water supply system. A warning level indicates a severe situation and the possibility that a drought emergency may be necessary. A

drought emergency is one in which mandatory water restrictions or use of emergency supplies are necessary.

The action levels specified in this document are a general plan of action to coordinate statewide response to drought situations. However, numerous individual agencies have particular responsibilities that they are responsible for implementing on an ongoing basis. In addition, individual communities have a range of actions they can take to manage their systems during droughts. These actions are taken based on local assessment of local conditions and may not progress through the same levels outlined above. The various responsibilities of those with responsibilities for addressing drought issues are briefly discussed below.

6. Drought Response

6.1 Local Governments

Local governments or waters suppliers, either independently or in conjunction with the DEP, are responsible for the management of their system to ensure that they can provide water sufficient to meet public health and safety needs. Though this drought plan is intended to coordinate the state and federal agencies as they work with local governments and others to assess and respond to dry conditions and droughts, the agencies recognize the fundamental role that local governments play. Key to this function is ensuring that local suppliers have an up-to-date emergency response plan that includes plans for responding to droughts and identifying existing and potential emergency water supplies. It also includes ensuring that the public and elected officials at the local level are educated on the need to impose water restrictions and other measures early so that serious deficits, pressure problems or water quality issues are avoided to the greatest extent possible. Appendix E outlines the major elements that water suppliers should have in place to ensure their readiness for drought situations.

When dry conditions occur, actions by local government and water suppliers can range from requesting voluntary compliance with water use restrictions to declarations of local water emergencies (either under local bylaw or through petition to the DEP) based on the status of their local water supplies. These local decisions are taken independently of the state responses outlined below. These local decisions provide valuable information about water shortages to state agencies, who are able to assess the broader situation being faced within a particular region. In addition, it is anticipated that state drought status levels and communication to water suppliers about such levels will prompt local action by communities.

6.2 Department of Environmental Protection

DEP has the authority to declare water emergencies for communities facing public health or safety threats as a result of the status of their water supply system, whether caused by drought conditions or for other reasons. Such local-based response is perhaps the most important element in managing public water supplies during drought situations as almost all water supplies are locally or regionally controlled. The DEP's authority to declare local emergencies is outlined in detail in section 8.2.1 of this plan.

6.3 Agriculture

Crop losses can pose severe financial impacts on farmers, aquaculturists, and other agricultural businesses. The Department of Food and Agriculture is responsible for recommending to the Governor, through the Secretary of Environmental Affairs, an emergency declaration or other needed steps based on either actual or predicted impacts to agricultural products. This declaration is often made in anticipation of crop failures so that the Commonwealth will be eligible to receive federal disaster assistance from the U.S. Department of Agriculture (USDA). The Department of Food and Agriculture is also responsible for communicating with USDA to determine the types and timing of federal assistance that may be available and ensure that the state applies for such assistance as needed. If the assistance is available to individual farms, the Department works to ensure that these farmers are aware of the aid that is available to them.

6.4 Forestry

Risk of fires in wild land, rural areas, state forests and parks are linked to dry conditions. In addition, a drought can impact the availability of water for fire suppression. Assessment of fire risk and management of fire control resources is an on-going activity of the Bureau of Forest fire Control under the Department of Environmental Management. It is the responsibility of DEM Director of Forestry to manage state fire suppression resources and to coordinate with other local, state, federal agencies and other states to coordinate the appropriate resources given the situation.

6.5 Department of Fisheries and Wildlife

Dry conditions can lead to a range of impacts to fisheries and wildlife, from reducing food sources to fish kills or displacement of certain populations of animals. Department responses include responding to incidents of wildlife entering residential or urban areas. They also include identifying developing impacts to specific fisheries and wildlife populations so that other agencies, such as local governments, DEP or others, can implement measures to reduce the impacts to these resources. For example, if low streamflows threaten fish populations, DFW can work with DEP and local municipalities to ensure that water restrictions are in place to minimize the impact from water use in these areas.

6.6 Massachusetts Emergency Management Agency (MEMA)

Dry conditions can have severe impacts on public water supply providers, farmers and other water users. MEMA is responsible for coordination of Federal, State, local, voluntary and private resources during a large-scale emergency. MEMA's network includes public health and safety officers, emergency workers, fire, police, public works and transportation officials, non-profit & volunteer agencies, private businesses & industry and all Federal agencies. MEMA's coordination effort includes rapid deployment of appropriate resources, such as drinking water, to sustain public health and safety.

MEMA is responsible for maintaining the Massachusetts Comprehensive Emergency Management Plan (CEMP). The Massachusetts CEMP establishes the fundamental policies, basic program strategies, assumptions and mechanisms through which the

Commonwealth will mobilize resources and conduct activities to guide and support local emergency management efforts through response and recovery. It is anticipated that the Massachusetts Drought Management Plan will be an addendum to the CEMP.

6.7 Department of Public Health

Dry conditions can impact the availability of water and the quality of water. Low water pressures can result in bacteria problems in water distribution systems. Low water levels in surface water supplies can also result in water quality problems. The Department of Public Health (DPH) in conjunction with DEP monitor drinking water quality in communities. DPH also provides notification to communities on necessary steps to purify drinking water.

6.8 Federal Drought Plan

The National Drought Policy Commission has reported to Congress on developing a national drought policy. The Commission evaluated the needs of state and local authorities for responding to drought situations. The report, Preparing for Drought in the 21st Century, includes a drought policy statement and recommendations for preparedness, and federal support of state and local programs to mitigate the impact of drought. The report is available on line at www.fsa.usda.gov/drought/.

6.9 State Drought Response Actions

Table 3 outlines the general level of activity given the severity of the situation. It is anticipated that drought responses will be directed to regions of the state based on the regional assessment of drought levels. The table begins with general information collection and sharing of that information under normal or drought advisory conditions to preparation and declaration of an emergency situation by the Governor. The definition of each action level is provided in the next section of the plan.

The actions in Table 3 provide a general outline of the actions to be taken by various agencies as dry conditions persist and droughts develop. These actions are not intended to limit or inhibit the discretion of the agencies as they undertake certain activities. Also, as discussed further in Section 7 on drought indices, some actions may be triggered by particular drought indices, rather than waiting for the DMTF to meet and determine the level of drought that exists.

Table 3 – State Drought Action Plan

Drought Level	Response/Actions
Normal Conditions	(1) DEM collects basic weather and hydrological data and produces monthly “Current Conditions” report. (2) DEP encourages communities to adopt local bylaws that provide for drought related contingency plans.
Drought Advisory	(1) DEM distributes monthly summary of dry conditions (Current Conditions Report) to DMTF. (2) DEP communicates with municipalities and Massachusetts Water Works about dry conditions.

	<ul style="list-style-type: none"> (3) MEMA/EOEA contact members of DMTF and call a meeting of DMTF. (4) MEMA/EOEA develop general press announcements as necessary. (5) DEP/DPH/EOEA begin to coordinate on a regular basis to exchange information regarding status of drinking water supplies. (6) DFA/DFW/EOEA begin to coordinate on a regular basis to exchange information regarding the status of agriculture, fisheries and wildlife impacts (7) Agencies expand data collection and monitoring. Forward “Current Conditions” report to drought task force coordinators.
Drought Watch	<ul style="list-style-type: none"> (1) Assessment and recommendations coordinated through Drought Management Task Force (DMTF). (2) Intensified monitoring and appraisal of drought situation through information gathering of state agencies. (3) DEP offers technical assistance to communities on managing systems during dry conditions, including assistance on use of emergency connections and supplies. (4) DEP ensures towns know how to request a declaration of drought emergency. (5) DFA/DFW provide more detailed assessment of environmental/agricultural impacts of worsening conditions. (6) DMTF coordinators undertake public information distribution regarding current conditions and general conservation measures. (7) DMTF coordinators develop press strategy to communicate information on drought. (8) DMTF coordinators prepare memorandum on status of situation for Secretaries of Environmental Affairs, Public Safety and Commissioner of Public Health. (9) Initiate contact and planning efforts with federal agencies.
Drought Warning	<ul style="list-style-type: none"> (1) Develop measures to reduce water use and protect public and vital health, economic and environmental interests. Fully implement and promote public information and technical assistance. (2) EOEA and MEMA implement press strategy to keep media and public informed about the situation (3) DMTF coordinators collect information on availability and use of emergency sources of water. (4) DPH works closely with local boards to assess public health threats and take actions as needed. (5) Initiate contact and planning with New England states and New York regarding situation and to alleviate

	<p>drought impacts.</p> <p>(6) Prepare Governor Proclamation of a drought emergency in regards to a potential drought emergency.</p> <p>(7) Recommend to Governor on communications strategy.</p> <p>(8) Develop recommendations for special legislation and/or funding.</p> <p>(9) Begin process to utilize appropriate federal assistance options.</p>
Drought Emergency	<p>(1) Finalize Governor Proclamation of a drought emergency to utilize state emergency authorities and powers to restrict water uses and implement measures to provide emergency water supplies.</p> <p>(2) DMTF continues to coordinate response of state, local and federal agencies.</p> <p>(3) Secure emergency funding and/or legislation.</p> <p>(4) Secure federal assistance.</p>

6.10 End of Drought Conditions

Once a drought has ended as defined in section 7.2, DMTF members should communicate this information to their target audiences, as described in section 4.2. This message should not only include an update on the current conditions, but should communicate the need for general conservation measures and emergency planning as part of good water resource management practice.

7. Drought Severity Indices

As dry conditions can have a range of different impacts, a number of drought indices are available to assess these various impacts. The Commonwealth will use a multi-index system that takes advantage of several of these indices to determine the severity of a given drought or extended period of dry conditions.

7.1 Drought Levels

In order for the Drought Management Task Force to assess the severity of a drought, 5 levels of drought have been identified. The levels are Normal, Advisory, Watch, Warning, and Emergency. A determination of which level has been reached is based on 7 indices: Palmer Drought Severity Index, Crop Moisture Index, Fire Danger, Precipitation, Ground-water levels, Streamflow levels, and Index Reservoir levels. A detailed description of each index is provided below.

These drought levels are based on the conditions of natural resources. These levels are intended to provide information on the current status of water resources. Drought levels will also be defined in community drought management plans. These local drought indices should factor in both water resource conditions and system specific responses to those conditions at the local level. Because local drought management plans are system specific the terminology for drought action levels may differ.

Drought level will be determined on a monthly basis based on the number of indices which have reached a given drought level. Drought levels would be declared on a regional basis for each of 6 regions in Massachusetts: Northeast, Southeast, Central, Connecticut River, Western, Cape Cod and Islands. It has been recommended that county by county determinations be made also. A map and list of the regions, and the counties included in them is included in Appendix B.

Once a drought level of warning and emergency have been reached for the precipitation index, conditions must improve beyond the previous level before a determination is made to reduce the warning or emergency.

7.2 Drought Indices

Palmer Drought Index – an index that reflects soil moisture and weather conditions; available from the National Weather Service or National Climate Data Center.

Crop Moisture Index – an index that reflects short-term soil moisture conditions as used for agriculture; available from the National Climate Data Center.

Fire Danger – the fire danger level reflects how favorable conditions are for brush fires. Data factored into the index include weather conditions and available fuel. This is a short-term index, which can change daily. The duration of the index will be used to determine relative drought levels. The fire danger level is available from the DEM Bureau of Fire Control, Chief Fire Warden.

Precipitation – a comparison of measured precipitation amounts to 30-year averages. Cumulative amounts for 3, 6 and 12-month periods are factored into the drought determination. This data is available from the DEM, Office of Water Resources.

Ground-water levels – a drought level determination is based on the number of consecutive months ground-water levels are below normal (lowest 25% of period of record). Ground-water conditions maps showing areas of above normal, normal and below normal are provided monthly by the USGS.

Streamflows – a drought level determination is based on the number of consecutive months streamflow levels are below normal (lowest 25% of period of record). Streamflow conditions maps showing areas of above normal, normal and below normal are provided monthly by the USGS.

Reservoirs – a drought level determination will be based on the level small, medium and large index reservoirs across the state. The reservoir level relative to normal conditions will be considered. DEM, Office of Water Resources, as part of its monthly conditions report, will maintain a list of index water supply reservoirs and their percent full.

Table 4
Drought Indices

Drought Level	PDI	CMI*	Fire*	Precipitation	Ground Water	Streamflow	Reservoir
Normal	-1.0 to -1.99	0.0 to -1.0 slightly dry	Low	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for the time of year
Advisory	-2.0 to -2.99	-1.0 to -1.9 abnormally dry	Moderate	2 month cumulative below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index Reservoirs below normal
Watch	-3.0 to 3.99	-2.0 to -2.9 excessively dry	High	1 of the following criteria met: 3 month cum. < 65% or 6 month cum. < 70% or 12 month cum. < 70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index Reservoirs below normal
Warning	-4.0 and below	< -2.9 severely dry	V. High	1 of the following criteria met: 3 month cum. < 65% and 6 month cum. < 65% or 6 month cum. < 65% and 12 month cum. < 65% or 3 month cum. < 65% and 12 month cum. < 65%	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
Emergency	-4.0 and below	< -2.9 severely dry	Extreme	Same criteria as Warning And Previous month was Warning or Emergency	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

*The Crop Moisture Index and the Fire Danger levels are subject to frequent change. The drought level for these two indicators is determined based on the repeated or extended occurrence of each index at a given level. ** below normal for groundwater and streamflow are defined as being within the lowest 25% of the period of record.

7.2 Determination of the End of a Drought

Determinations on the end of a drought or to reduce the drought level will focus two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on streamflow, water supply, reservoir levels, soil moisture and potential for forest fires. Precipitation is a key factor because it is the overall cause of improving conditions. Groundwater levels respond slowly to improving conditions so they are a good indicator of a long-term recovery to normal conditions.

A given drought action level can change in one of three ways after the first month it has been reached. If conditions reach the criteria for the next drought level, the severity will be increased. If conditions persist but do not reach the next level, the drought action level will be held constant. If conditions improve, the severity can be reduced based on either site-specific information or on progress toward returning to normal.

A drought emergency will end when the conditions that led to the specific emergency have abated. For example, a critically low reservoir will need to have made a significant recovery, or groundwater wells will need to have returned to a normal operating capacity. If an emergency has been declared based on environmental impacts, the emergency will end when these conditions have abated.

Drought warnings, watches and advisories can be reduced based on 1) normal levels of precipitation and/or 2) groundwater levels within the “normal” range. USGS defines normal as groundwater levels that are in the range of 25th-74th percentile of the period of record. Therefore, groundwater levels within the normal range can include situation when groundwater levels are less than an average condition.

In order to return to a normal status, ground water levels must be in the normal range and/or one of two precipitation measures must be met. The precipitation measures are: 1) three months of precipitation that are cumulatively above normal, and 2) long-term cumulative precipitation above normal. The period for long-term cumulative precipitation will range from 4 to 12 months depending on the time of year. Precipitation falling during the fall and spring are ideal for ground water recharge and therefore will result in the quickest return to normal conditions. Because the same level of cumulative precipitation can differ in their ability to reduce drought conditions, the decision to reduce a drought level will depend on the professional judgement of key DMTF members such as the National Weather Service and the Water Resources Division of the Department of Environmental Management.

Part of this interpretation of the short and long-term measures, precipitation will include the need to discount the effect of short-duration large storms such as hurricanes. While these storms may return long-term precipitation levels to normal and may fill reservoirs, they often do little to replenish groundwater levels necessary for long-term water resource protection. Their review will also take into account other data as reported from DMTF members (as described in section 3 of this plan).

A majority of the indices are not used to determine an end of a drought because many of the indices will tend to return to normal at some point during the year. For example, the

Crop Moisture Index returns to normal at the end of the growing season. The Fire Danger season ends with snowfall. In addition the end of a drought is easily defined by rainfall and ground-water levels, which has the most significant impact on the other indices.

8. Emergency Declarations-Legal Authorities and Powers

The following section discusses the local, state, and federal authorities and powers related to drought situations. This section provides a general summary of the laws applicable to drought issues. However, the appropriate legal staff should be consulted in advance of the use of any of these powers by a state agency.

8.1 Local

Municipal governments are critically important to managing drought situations and assessing the impact of drought situations. Municipal governments that own, operate or oversee a public water supply are responsible for putting in place either voluntary or mandatory water use restrictions. State level response to droughts is premised on the fact that local authorities are taking all necessary action to manage drought situations and to protect public health and the environment.

Municipalities are authorized to adopt and implement bylaws in appropriate circumstances, for example to regulate public water supply pipes or to manage their prudential affairs and preserve peace and good order under their police powers, pursuant to G.L. c. 40, § 21, and c. 41, § 69B. Municipalities, which have established water supply or distributing systems, may regulate through such bylaws the use of water from the municipal system. Further, when DEP determines that an emergency exists in the case of a drought or disaster, a municipality may, following appropriate notice, regulate or otherwise restrain the use of water on public or private property (regardless of whether the supply source is public or private) pursuant to G.L. c. 40, § 41A. Municipalities, particularly those that experience chronic water shortages, are encouraged to promulgate bylaws to address necessary rules for responding to an actual or threatened drought condition.¹

In the event of a declared emergency, a municipality may, generally, raise, appropriate and expend money for the purposes of maintaining, distributing and providing at reasonable rates a sufficient supply of the common necessities of life, which includes water.

¹ For an example of a model “water use restriction” bylaw, please visit the follow page at DEP’s website: <http://www.state.ma.us/dep/brp/dws/dwspubs.htm#model>

8.2 State Agencies

8.2.1 Department of Environmental Protection

DEP's authority for addressing water supply shortage emergencies is derived from the Water Management Act, MGL. c. 21G, §§ 15-17 and from MGL c.111, Section 160, related to ensuring the provision of safe drinking water.

Any operator of a public water system, such as a municipality, Water Company or other public agency, may petition DEP to declare a state of water emergency. MASS. GEN. L. c. 21, § 15 (1998). In declaring such a state, DEP must find that "there exists or impends a water supply shortage of a dimension which endangers the public health, safety or welfare." Id. DEP must limit the applicability of the state of water emergency to the petitioning municipality or to the area served by the petitioning public water supplier, whichever the case. Id. A state of emergency shall not extend longer than six months.

In declaring a state of water emergency, DEP may require the municipality or water supplier to submit a plan, which must be approved by DEP, designed to address and resolve the emergency. This plan may include provisions for shutting off water on public or private property, and DEP may further require the following: (1) an approved water resources management plan; (2) a leak detection program; (3) a program for auditing water use; (4) a program for overall system rehabilitation; (5) conservation programs for public and private buildings; (6) bans or restrictions on certain water uses; (7) a moratorium on the issuance of building permits; (8) a plan for establishing priority for distribution of water among competing uses; and, (9) drought management or contingency plans.

Once a state of water emergency is declared, DEP has significant authority to address the emergency. DEP may take by eminent domain the right to use any land for the time necessary to use water on the land for addressing the emergency. MASS. GEN. L. c. 21, § 16 (1998). In the case of a water emergency affecting the MWRA system, MDC, rather than DEP, has such eminent domain authority. Id. This eminent domain authority seems narrower than that which the Governor may exercise following a declaration of a state of emergency under the CDA. Further, any such taking by eminent domain must be approved by the municipality in which the proposed taking will occur. Id.

During a state of water emergency, DEP may issue orders, applicable within or outside the affected area of the water emergency, to: (1) establish priorities for the distribution of any water or quantity of water use; (2) permit any person engaged in the operation of a water supply system to reduce or increase by a specified amount or to cease the distribution of that water; to distribute a specified amount of water to certain users as specified by the department; or to share any water with other water supply systems; (3) direct any person to reduce, by a specified volume, the withdrawal or use of any water; or to cease the withdrawal or use of any water; (4) require the implementation of specific water conservation measures; and, (5) mandate the denial, for the duration of the state of water emergency, of all applications for withdrawal permits within the areas of the commonwealth to which the state of water emergency applies.

The Department of Environmental Protection is also granted broad powers to protect the public health through the oversight of water supplies as provided in MGL 111, Section 160. This section gives the department the ability to “...make rules and regulations and issue such orders as in its opinion may be necessary to prevent the pollution and to secure the sanitary protection of all such waters used as sources of water supply and to ensure the delivery of a fit and pure water supply to all consumers.” The statute also provides DEP the ability to “make such orders relative thereto (complaints about water supplies) as it may deem necessary for the protection of the public health and to restrain the use of such waters to the extent as in its opinion such use will tend to adversely affect the public health.”

Violation of orders, rules or regulations under this section are punishable by either fines of up to \$25,000 per day for each day a violation occurs or by imprisonment for not more than one year, or both; or by a civil penalty up to \$25,000 per day for each day a violation occurs.

8.2.2 Massachusetts Water Resources Authority

The MWRA, which serves the water needs of many municipalities in the metropolitan Boston area, is generally authorized to develop programs, procedures and regulations for water conservation, leak detection and repair. MASS. GEN. L. c. 92 App., § 1-8(m) (1998). Such programs and regulations may also provide for “water use limitations in the time of drought or other emergency.” *Id.* With respect to water emergencies, MWRA and its communities have the power to provide connection and supply to adjoining communities under an order from DEP with appropriate compensation to MWRA. Sec 8 (d). This tracks DEP's powers under c. 21G, but doesn't go beyond them. Further, in an emergency situation, MWRA is authorized to incur expenses in excess of those shown in its annual budget. MASS. GEN. L. c. 92 App., § 1-8(b) (1998).

The MWRA has developed a drought management plan for its system that is tailored to the capacity of its system. The MWRA has daily on-line tracking of its system, including reservoir levels and system demand, as well as sophisticated modeling ability to predict the ability of the MWRA system to meet short and long-term demands. The MWRA drought management plan should be referred to for more details.

MWRA is charged with promoting water conservation, protecting the adequacy of a pure water supply and improving environmental quality under Section 8(e) and has general authority to promote leak detection and water conservation through its regulations, charges and other programs under section 8(m). Section 8(m) specifically includes water use limitations in time of drought or other emergency.

8.2.3 Department of Public Health

The Department of Public Health (DPH) has broad authority over matters affecting public health and is mandated to “take cognizance of the interests of life, health, comfort and convenience among the citizens of the commonwealth.” M.G.L. c.111 s. 5. DPH is specifically mandated to “conduct sanitary investigations and investigations as to the causes of disease...” M.G.L. c. 111 s. 5. With regard to water quality, DEP is required to report to DPH any violations of DEP regulations relating to drinking water quality

standards and based upon that report or upon its own investigation, DPH may order the appropriate party to cease violating the water quality standards and take whatever steps are necessary to purify the water. If any such order of DPH conflicts with any order of DEP, the order of DPH takes precedence. M.G.L. c. 111 s160B. DEP regulations require DEP to report to DPH all violations of DEP drinking water regulations and to consult with DPH with regard to enforcement actions taken to obtain compliance with DEP drinking water regulations 310 CMR 22.03(4).

In addition, pursuant to M.G.L. c. 111 s. 127A, DPH has promulgated State Sanitary Code Chapter II, entitled Minimum Standards of Fitness for Human Habitation, which requires all owners of residential dwellings to provide a potable water supply. 105 CMR 410.180. Local boards of health have primary authority to enforce the sanitary code requirements, but DPH may enforce these regulations if the local board of health fails to act.

8.2.4 Massachusetts Emergency Management Agency

MEMA is responsible for direction and control of all state emergency operations as outlined in Chapter 639, Acts of 1950. The Massachusetts Comprehensive Emergency Management Plan (CEMP) is the framework for managing emergency response and recovery actions at all levels of government in the Commonwealth. Utilizing the CEMP, MEMA coordinates state, federal, and private resources with regard to planning, response and recovery activities. The Drought Management Plan is an example of such coordination between EOEA and MEMA. Should a declaration of a state of emergency be warranted as a result of drought conditions, the CEMP would be the framework for response and recovery actions.

Executive Order 144, issued in 1978 to facilitate planning for, and operations during disasters and emergencies, requires state agencies to designate liaison officers to MEMA for the purposes of coordinating resources, training and operations. The Massachusetts Emergency Management Team (MEMT) consists of these representatives who are authorized to deploy the resources which their organizations can provide to local governments during emergencies or disasters. A list of the agencies and their responsibilities is available in the CEMP.

8.2.5 Governor Declared State of Emergency

The Commonwealth has several established mechanisms for responding to drought conditions. The legislature has placed the primary statutory-based drought management tools at the disposal of the Governor and the DEP.

Chapter 639 of the Acts of 1950, as amended by Chapter 425 of the Acts of 1958, (the “Civil Defense Act” or “CDA”) allows the Governor to proclaim a state of emergency to address certain situations, which may occur in all or in a part of the Commonwealth. When it may be reasonably anticipated that the health, safety or property of the citizens will be endangered, the Governor may declare the existence of such an emergency situation due to a shortage of water resulting from an absence of rainfall or from the occurrence of a disaster or catastrophe of natural causes. Section 5 of Chapter 639 of the Acts of 1950, as amended. A proclamation of such a state of emergency provides the

Governor with expansive power, authority and discretion to address and resolve the declared emergency.

During a state emergency, section 5(a) of the CDA provides the Governor the authority to employ every agency and the members of every department towards protection of the lives and property of the citizens and to enforce the law. Under section 5(b) of the CDA, the Governor may, in the event of a disaster or shortage that makes such action necessary for the protection of the public, take possession of land and many types of personal property, permanently or temporarily. The owner of any such property taken, however, is entitled to just compensation for its value. Section 7 of the CDA provides the Governor with the authority “to exercise any and all authority over persons and property, necessary or expedient for meeting the state of emergency,” including for example, policing, protecting or preserving all property, public or private. This broad authority should provide the Governor the power to take necessary steps, such as restraining the use of water on private property, to address an actual or threatened drought.

In addressing threatened disaster or danger of drought to civil defense, pursuant to section 4 of the CDA, the Governor has the authority to cooperate with federal authorities and other states, propose a comprehensive plan and program, conduct studies and surveys, ascertain the capabilities of the Commonwealth, and delegate any such administrative authority provided to him under the Civil Defense Act. Pursuant to section 8 of the CDA, the Governor may exercise, in advance, any powers conferred under the CDA as requires preparation in anticipation of a declaration of an emergency, including issuing executive orders or promulgating regulations. The violation of any such executive order or regulation shall be punished by imprisonment for not more than one year or by a fine not to exceed \$5,000, or both.

APPENDIX A

Drought Management Task Force Contact list

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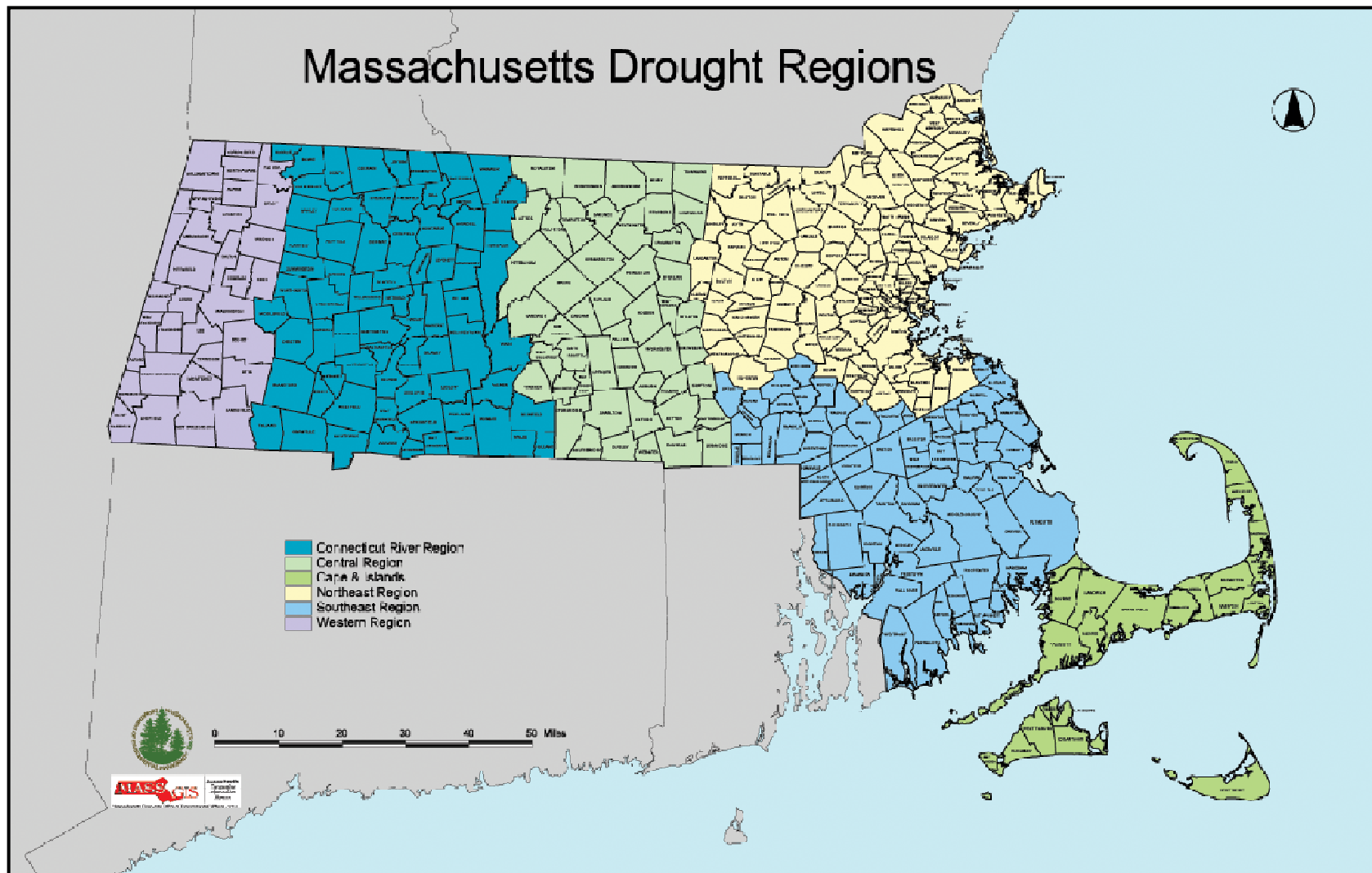
Massachusetts Water Works Association

Carol Harris
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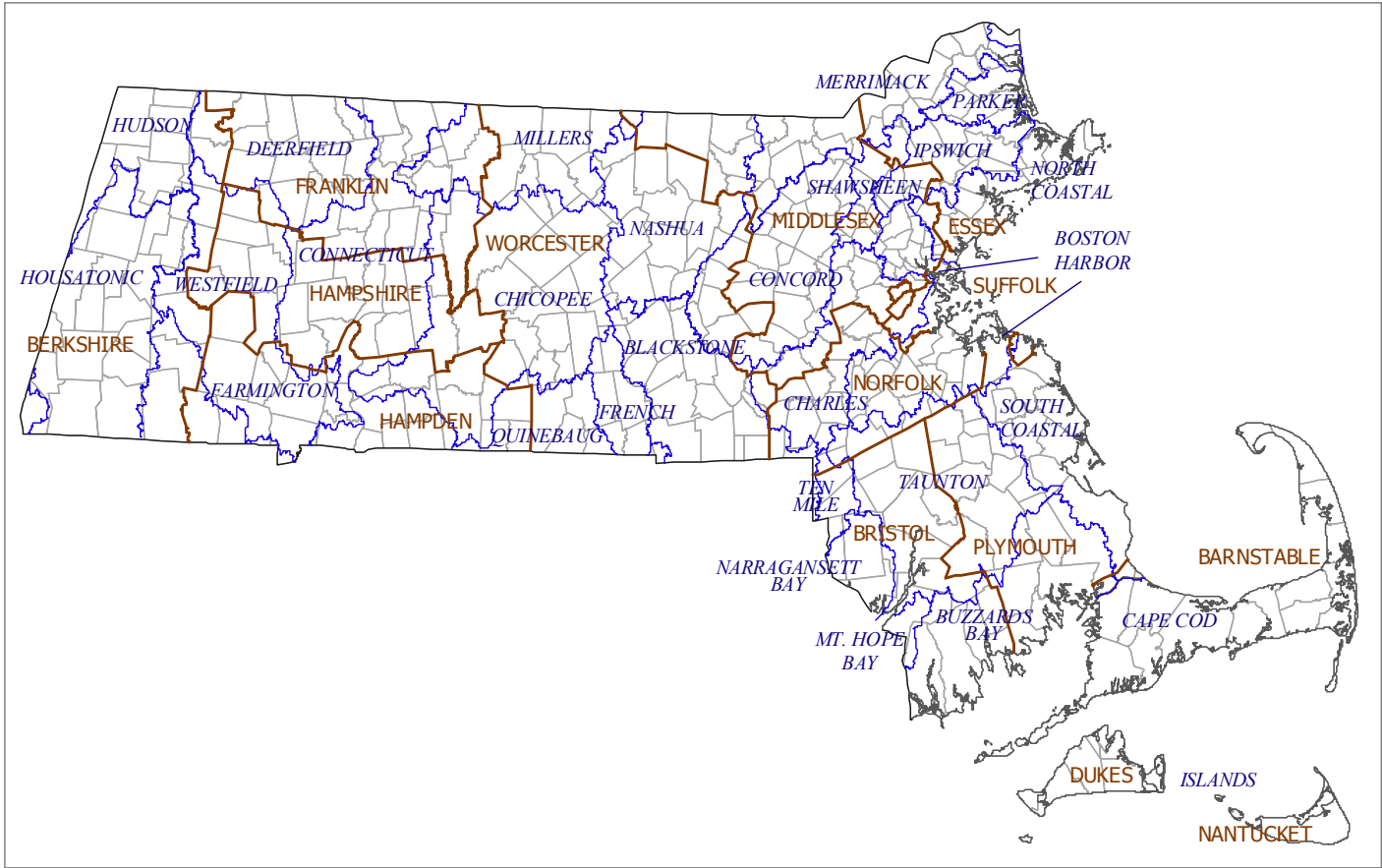
**Water Supply Citizens Advisory Committee (WSCAC)
For the MWRA**

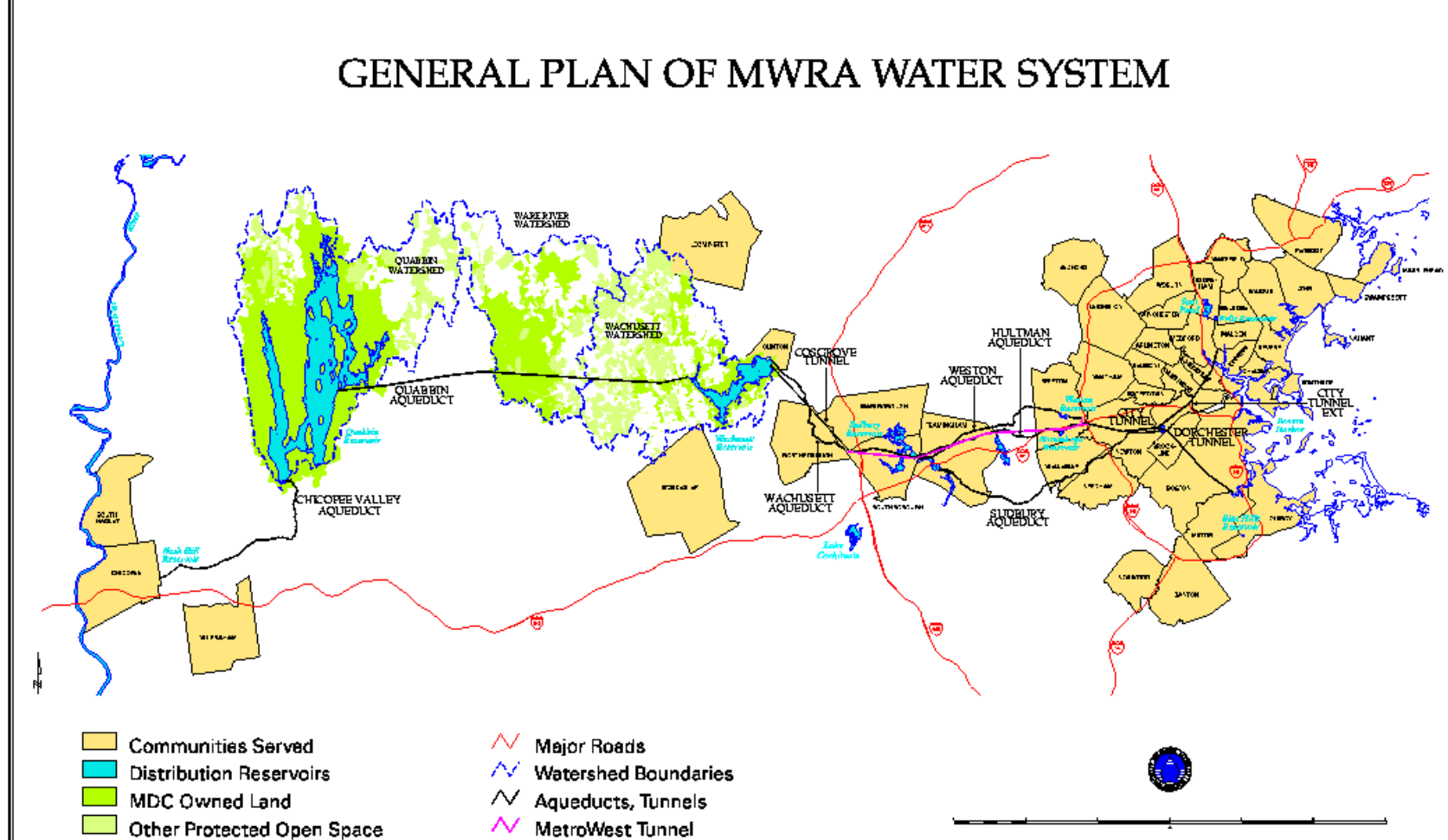
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APPENDIX B



MAP OF WATERSHEDS AND ASSOCIATED COUNTIES





Appendix D

Drought Preparedness for Local Governments and Water Suppliers

Contingency plans for drought circumstances are a critical component of any water supply management program in order to establish what levels of dry or drought conditions are likely to lead to a water supply emergency and what actions will be taken to prevent the emergency and/or respond should one occur. According to the American Water Works Association “A well conceived drought management plan can take the “crisis” out of the situation . . . [and] can lessen any public perception that the utility’s actions are ill considered or arbitrary. . . . a drought management plan can enhance public acceptance of the actions to be taken in response to a water supply emergency.”

This guidance focuses on four key elements that local governments and water suppliers should have in place to address dry conditions. These are:

- development of drought plans
- development of emergency response plans
- passage of water restriction by-laws;
- identifying emergency water connections and water supplies

Each is briefly discussed below, followed by Appendix E, which includes a copy of the DEP model bylaw for water restrictions.

Drought Management Planning

While severe droughts can result in dire emergency situations, they are generally slow developing and therefore provide the opportunity to take actions to minimize their impacts on water supplies and the environment. Identifying drought indicators and drought triggers is essential to developing an effective drought management plan. Drought indicators are used to assess the status of water supplies and the status of the impact of water withdrawals on the environment.

The drought indicators for particular water supply systems will depend on the specific conditions of the system, such as the capacity of storage and treatment facilities, storage tank elevation, reservoir storage, streamflow levels, groundwater levels and precipitation. They will also depend on the location and sensitivity of environmental resources. Drought triggers act as benchmarks that provide warning signals of impending or ongoing water shortage.

The purpose of developing triggers is to link them with specific response actions to plan for dry conditions and mitigate drought impacts. A key response action is the ability to restrict water use restrictions. Water use restrictions can move from limited and voluntary actions to more extensive mandatory restrictions depending on the drought stage triggers. The development of a drought plan with both clear triggers and clear responses will provide communities and water users predictable responses to dry conditions and droughts.

Local governments need to enact a water restriction by-law in order to have the ability to impose mandatory water restrictions without receiving a emergency declaration from the Department of Environmental protection. Water use restrictions should be tailored to the

needs of the community or water district, but should include a variety of levels or stages so that the appropriate response is available based on the severity of the situation.

The following example provides four different stages. As part of a drought management plan, each of these stages would be implemented based on pre-established triggers. Please note that an odd/even day water use restriction is not included because this type of restriction may actually encourage users to water more often than necessary.

Stage I. Voluntary conservation

Stage II Off peak watering only. *Offpeak watering may not reduce overall demand, but can reduce peak demands.*

And/or

Outside water use is limited to between *** and *** (name particular hours). *Such a restriction is useful when the system generally has sufficient water quantity, but is has system limitation in meeting peak demands.*

Stage III. Outside water usage is limited to 1 day per week.

And/or

Outside water use restricted to hand held hose for flower or vegetable garden watering only. No lawn watering, car washing (excluding commercial car washing), or pool filling, allowed.

Stage IV. Mandatory ban on outside water use. All outside use of water is forbidden and subject to penalties in accordance with law for violation of this restriction

The American Water Works Association has developed a manual entitled *Drought Management Planning* to assist suppliers in developing drought management plans. To obtain a copy contact the American Water Works Association 1-800-926-7337 and refer to ISBN # 0-89867-627-4.

Emergency Response Planning

Communities should also develop emergency response plans that cover a broader range of emergencies beyond droughts. These plans provide the framework for responses when water supply situations become critical. The Department of Environmental Protection has put out the **Handbook for Water Supply Emergencies** that outlines the key components of such an emergency plan. These plan develop specific procedures for various levels of emergency, include lists of key phone numbers and contact information for local, state and federal emergency response officials. The Handbook also contains an emergency response checklist and guidelines for preparing news releases to communicate with the public.

Water Restriction Bylaws

All communities responsible for operating public water supply systems should have a water restriction bylaw in place. These bylaws give the appropriate person or board the power to declare water restrictions as necessary. These powers are important to allow a community to have a predictable plan to reduce water use as drought conditions develop. If communities do not have these powers, they can only institute such restrictions by requesting a declaration of emergency from the Department of Environmental Protection. However, waiting for an emergency situation to occur means the town will have missed opportunities to reduce non-essential water uses early, and therefore missing the opportunity to prolong the sufficiency of local supplies and forestalling more drastic measures such as emergency hook-ups or providing bottled water to meet local needs

Emergency Supplies and Emergency Connections

In order to assure that a community is fully prepared for drought conditions and for other emergencies they should have emergency connections to other supplies and/or have plans to access contingency water supplies. Such efforts should include connections to nearby public water supplies, identification of emergency sources of water, and contingency contracts to purchase water by tanker truck or bottled water. Contingencies should include identification of non-potable water sources that can be used for fire protection or for use in conjunction with boil orders. By having these contingencies in place communities can ensure that they can protect public health and safety during the most severe droughts or emergency.

APPENDIX E

DEP MODEL WATER USE RESTRICTION BYLAW/ORDINANCE

This is a model provided by the Department of Environmental Protection for use by municipalities in developing their own bylaws to regulate the use of water supplied by a municipal water system. It is for communities wishing to establish enforceable limitations on the use of water during temporary periods of high water demand. If properly enacted, the municipal bylaw will enable municipal water systems to control and mitigate periods of high demand - with an associated stressed water supply - typically occurring during the summer months. The restrictions included in the bylaw include odd/even day outdoor watering, limited outdoor watering hours, outdoor watering bans, and prohibitions on filling swimming pools and the use of automatic sprinkler systems. Persons violating the bylaw's restrictions are subject to civil fines. If a municipality is experiencing complex system problems affecting its ability to consistently provide an adequate supply of water, adopting and implementing the model bylaw may not address the problem. In that case a declaration of water supply emergency under M.G.L. c.21G, §15-17 should be requested from the Department. After enactment, the Department would like to be notified of the state of conservation imposed, and is planning to revise its regulations to require such notification. Local requirements for adopting bylaws may vary according to the terms of individual municipal charters. Consultation with town counsel is strongly advised before adopting any bylaw. The Department makes no representation concerning the legal effect or validity of this model.

CONSULT WITH YOUR TOWN COUNSEL TO INSURE ADOPTION OF AN APPROPRIATE, ENFORCEABLE AND LEGALLY VALID BYLAW THAT WILL MEET YOUR MUNICIPALITY'S NEEDS.

Section 1 Authority

This Bylaw is adopted by the Town under its police powers to protect public health and welfare and its powers under M.G.L. c.40, §§21 et seq. and implements the Town's authority to regulate water use pursuant to M.G.L. c. 41, §69B. This bylaw also implements the Town's authority under M.G.L. c. 40, §41A, conditioned upon a declaration of water supply emergency issued by the Department of Environmental Protection.

Section 2 Purpose

The purpose of this bylaw is to protect, preserve and maintain the public health, safety and welfare whenever there is in force a State of Water Supply Conservation or State of Water Supply Emergency by providing for enforcement of any duly imposed restrictions, requirements, provisions or conditions imposed by the Town or by the Department of Environmental Protection.

Section 3 Definitions

Person shall mean any individual, corporation trust, partnership or association, or other entity. State of Water Supply Emergency shall mean a State of Water Supply Emergency declared by the Department of Environmental Protection under M.G.L. c.21G, §15-17. State of Water Supply Conservation shall mean a State of Water Supply Conservation declared by the Town pursuant to section 4 of this bylaw.

Water Users or Water Consumers shall mean all public and private users of the Town's public water system, irrespective of any person's responsibility for billing purposes for water used at any particular facility.

Section 4 Declaration of a State of Water Supply Conservation

The Town, through its Board of Water Commissioners ², may declare a State of Water Supply Conservation upon a determination by a majority vote of the Board that a shortage of water exists and conservation measures are appropriate to ensure an adequate supply of water to all water consumers. Public notice of a State of Water Conservation shall be given under section 6 of this bylaw before it may be enforced.

Section 5 Restricted Water Uses

A declaration of a State of Water Supply Conservation shall include one or more of the following restrictions, conditions, or requirements limiting the use of water as necessary to protect the water supply. The applicable restrictions, conditions or requirements shall be included in the public notice required under section 6.

- a) Odd/Even Day Outdoor Watering Outdoor watering by water users with odd numbered addresses is restricted to odd numbered days. Outdoor watering by water users with even numbered addresses is restricted to even numbered days.
- b) Outdoor Watering Ban Outdoor watering is prohibited.
- c) Outdoor Watering Hours Outdoor watering is permitted only during daily periods of low demand, to be specified in the declaration of a State of Water Supply Conservation and public notice thereof.
- d) Filling Swimming Pools Filling of swimming pools is prohibited.
- e) Automatic Sprinkler Use The use of automatic sprinkler systems is prohibited.

Section 6 Public Notification of a State of Water Supply Conservation; Notification of DEP

Notification of any provision, restriction, requirement or condition imposed by the Town as part of a State of Water Supply Conservation shall be published in a newspaper of general circulation within the Town, or by such other means reasonably calculated to reach and inform all users of water of the State of Water Supply Conservation. Any restriction imposed under section 5 shall not be effective until such notification is provided. Notification of the State of Water Supply Conservation shall also be simultaneously provided to the Massachusetts Department of Environmental Protection.

Section 7 Termination of a State of Water Supply Conservation; Notice

A State of Water Supply Conservation may be terminated by a majority vote of the Board of Water Commissioners, upon a determination that the water supply shortage no longer exists. Public notification of the termination of a State of Water Supply Conservation shall be given in the same manner required by section 6.

Section 8 State of Water Supply Emergency; Compliance with DEP Orders

Upon notification to the public that a declaration of a State of Water Supply Emergency has been issued by the Department of Environmental Protection, no person shall violate any provision, restriction, requirement, condition of any order approved or issued by the Department intended to bring about an end to the State of Emergency.

Section 9 Penalties

Any person violating this bylaw shall be liable to the Town in the amount of \$50.00 for the first violation and \$100 for each subsequent violation which shall inure to the Town for such uses as the Board of Water Commissioners may direct. Fines shall be recovered by indictment, or on complaint before the District Court, or by non-criminal disposition in accordance with section 21D of chapter 40 of the general laws. Each day of violation shall constitute a separate offense.

Section 10 Severability

The invalidity of any portion or provision of this bylaw shall not invalidate any other portion or provision thereof.

¹ The terms “town” and “bylaw” used throughout this document are intended to also refer to cities and ordinances, respectively.

² References to Boards of Water Commissioners throughout this bylaw should be edited by particular Cities and Towns to accurately describe the municipal department or board having responsibility for the operation and maintenance of the water supply system.